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ANALYSIS AND SUMMARY OF FOREST FIRES IN COASTAL ALASKA

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INTRODUCTION

Fire control planning in coastal Alaska, although not as spectacular, is difficult compared with many areas. Fire has not been treated as a serious threat because the climate is characterized by heavy rainfall throughout much of the year. A fire control capability, geared to handle the normal light load, is at a distinct disadvantage if it has to be expanded to handle an emergency situation. Heavy fuel concentrations and the existence of even-aged--probably fire-established--timber types and old fire scars are nagging reminders not to become complacent.

The fire potential has been judged great enough to require organized protection. The administrator on such a low occurrence area has a very real need for sound planning. He must consider the remote chance of a disaster type of situation, as well as routine encounters. The need for adequate planning is obvious in both situations, but the means of achieving the former is much more evasive.

The fire history of an area, documented in individual fire reports, provides much of the base for both prevention and suppression planning. A systematic analysis has not been attempted previously in coastal Alaska because of the small number of fire reports available.

In this paper, we have analyzed and summarized information available from fire reports. Our objectives were to identify factors associated with fire occurrence and acreage burned and to provide a statistical summary. The information is intended to answer questions concerning who, when, where, and magnitude of the fire problem.

DATA SOURCE

Information related to time, area, cause, fuel, and fire danger was computerized for easy sorting and summarizing. Included were data taken from reports on all fires from 1956 through 1967 on National Forest land throughout Region 10 of the U.S. Forest Service.

Spread index and buildup index values, assigned to the reports for fires occurring prior to adoption of the National Fire-Danger Rating System, expanded the fire-danger data base. Index values for the date the fire was reported were assigned from the nearest selected station. Fire-danger records were computed for selected stations as part of a separate study.[1/]

[1/] Trigg, William M., and Noste, Nonan V. Summary and analysis of fire danger indexes for selected coastal Alaska stations. USDA Forest Serv. Pacific Northwest Forest & Range Exp. Sta., 21 pp., illus. 1969.

The number of fire reports provided a limited base for developing relationships or isolating the effect of influencing factors. This limitation was anticipated and the study directed at extracting what information was available.

FIRE OCCURRENCE

The fire problem in coastal Alaska is man-caused. Occurrences tend to be clustered around populated and high-use areas within Ranger Districts. A concentration occurred along the road system north of Seward in the Kenai District (fig. 1), a popular recreation area. The areas coincident to Juneau, Ketchikan, and Sitka also experience comparatively high occurrence. Areas of very low occurrence include Afognak Island, the eastern portion of the Anchorage District, the Chatham District around Yakutat, the expanse southeast of Juneau, and the Ketchikan District east of Behm Canal.

Trends in fire occurrence over time were examined to identify any shift in District fire loads. Changes reflect a response to prevention effort or increases in people's activities that start fires. There is little reason to expect occurrence rates to remain static. The management program in Region 10 is developing at an accelerated rate. Transportation improvements continue to provide better access for more people into the area.

Analysis shows small changes in the occurrence rate over the study period. The overall Regionwide occurrence rate decreased slightly over the 12 years, with 128 fires during 1956-61 and 115 fires during 1962-67. Two Districts apparently deviated from the regional pattern. The Kenai occurrence rate decreased while Ketchikan increased (table 1).

The problems of control and damage are closely tied to cover type. The impact of fire on the hemlock and spruce forest types is of special interest because of the commercial importance of these species. Regionwide, the hemlock-spruce cover type (table 2) is associated with the greatest number of fires. More fires occur in the black spruce, white spruce, and paper birch stands on the Anchorage and Kenai Districts of the Chugach Forest. The large number of fires in spruce-hemlock is not excessive when the acreage of this type is considered. Approximately 5.2 million out of 5.7 million acres of commercial forest land is classified as Sitka spruce, western hemlock, or mixed hemlock-spruce.[2/]

The National Fire-Danger Rating System spread index and buildup index are often interpreted as a measure of fire occurrence potential. The relationships between the indexes and number of fires by index classes are given in tables 3 and 4. A more complete description is attained by consideration also of the number of days within the fire danger classes. The distribution of days by fire danger classes for the period April through September was obtained

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[2/] Hutchison, O. Keith. Alaska's forest resource. Pacific Northwest Forest & Range Exp. Sta., USDA Forest Serv. Resource Bull. PNW-19, 74 pp., illus. 1967.

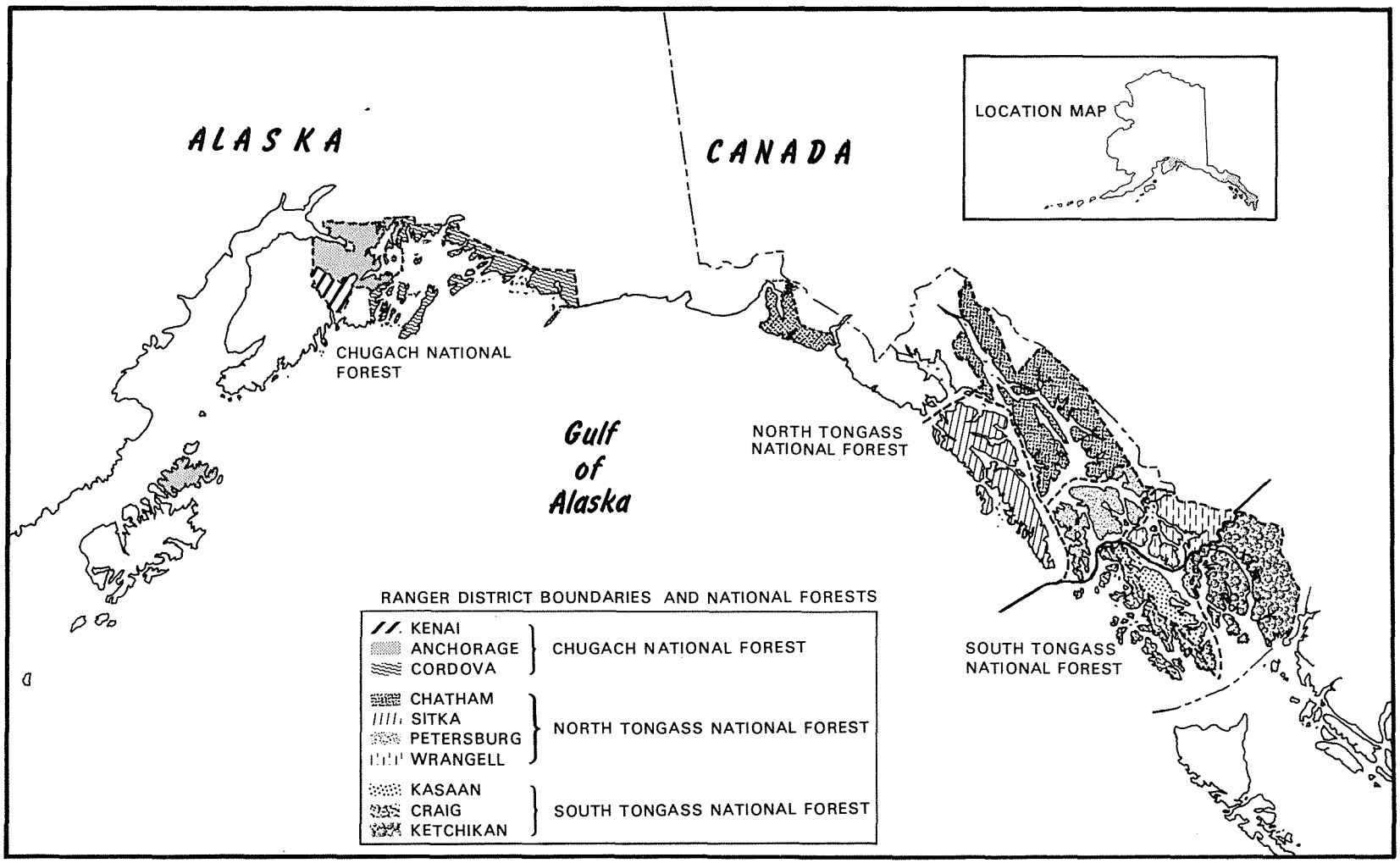

Figure 1.--Map showing Ranger Districts and National Forests in Region 10, Forest Service, U.S. Department of Agriculture.

Table 1.--*Fire occurrence in Region 10, Alaska, 1956-67; by Ranger District and year*

Year	Anchorage	Cordova	Kenai	Chatham	Petersburg	Sitka	Wrangell	Craig	Kasaan	Ketchikan	Region 10
1956	2	0	7	2	2	0	0	0	0	1	14
1957	2	0	15	5	3	3	0	0	1	0	29
1958	0	0	7	5	3	1	1	2	5	13	37
1959	4	0	8	1	0	1	0	0	2	1	17
1960	0	0	6	6	0	5	1	1	1	1	21
1961	2	0	5	0	0	0	1	2	0	0	10
1962	5	0	8	0	0	1	1	0	1	3	19
1963	2	1	6	3	1	2	0	0	1	5	21
1964	0	0	2	0	1	2	0	2	0	4	11
1965	0	0	3	8	2	5	2	0	2	4	26
1966	2	1	2	3	1	2	0	1	2	6	20
1967	1	0	1	4	3	3	2	0	0	4	18
Total	20	2	70	37	16	25	8	8	15	42	243

Table 2.--*Fire occurrence in Region 10, Alaska, 1956-67; by cover type and Ranger District*

Cover type	Anchorage	Cordova	Kenai	Chatham	Petersburg	Sitka	Wrangell	Craig	Kasaan	Ketchikan	Region 10
Nonforest	0	0	14	4	1	5	1	0	1	1	27
Scrub	2	0	3	4	1	0	0	2	3	11	26
Noncommercial interior woodland	0	0	0	1	0	1	0	0	0	0	2
Western hemlock	0	0	2	7	2	5	0	0	1	5	22
Sitka spruce	1	0	4	7	8	0	1	1	0	0	22
Hemlock-spruce	11	2	6	11	3	12	5	4	10	17	81
Cedar	0	0	0	0	0	0	0	0	0	2	2
Hardwood	0	0	1	2	0	0	0	0	0	0	3
Paper birch	0	0	9	0	0	0	0	0	0	0	9
Aspen	0	0	1	0	0	0	0	0	0	0	1
White spruce-paper birch	0	0	14	0	0	0	0	0	0	0	14
White spruce-aspen	0	0	3	0	0	0	0	0	0	0	3
Conifer slash	1	0	0	0	0	0	0	1	0	1	3
White spruce	4	0	10	0	1	1	0	0	0	0	16
Black spruce	1	0	2	0	0	0	0	0	0	0	3
Brush	0	0	1	1	0	0	0	0	0	5	7
Cover type unknown	0	0	0	0	0	1	1	0	0	0	2
Total	20	2	70	37	16	25	8	8	15	42	243

Table 3.--*Fire occurrence on the Chugach, North Tongass, and South Tongass National Forests, Alaska, 1956-67; by spread index class*

National Forest	Spread index class						
	0-10	11-20	21-30	31-40	41-50	51-60	61-70
Chugach:							
Number of fires	6	28	23	25	5	3	1
Cumulative number of fires	6	34	57	82	87	90	91
Cumulative percent of fires	7	37	62	90	96	99	100
Cumulative percent of days	12	38	66	86	96	99	100
North Tongass:							
Number of fires	17	17	18	10	10	2	0
Cumulative number of fires	17	34	52	62	72	74	74
Cumulative percent of fires	23	45	70	84	97	100	100
Cumulative percent of days	20	47	74	92	98	100	100
South Tongass:							
Number of fires	7	11	14	11	10	4	4
Cumulative number of fires	7	18	32	43	53	57	61
Cumulative percent of fires	11	30	52	70	87	93	100
Cumulative percent of days	19	48	74	91	98	99	100

from published fire danger summaries.[3/] The fire danger summaries of the Anchorage, Juneau, and Annette Island U.S. Weather Bureau stations were selected to represent the Chugach, North Tongass, and South Tongass National Forests, respectively.

Inspection shows that the distribution of days and fires is similar for both indexes on each forest. This means that both indexes have a similar relationship to occurrence. The distribution of fires follows the distribution of days (expressed as cumulative percentages) very closely on the Chugach and North Tongass Forests. This consistency in the ratio of fires to days indicates a weak relationship between the index and the number of fires per day. The index must associate a small percentage of days with a large percentage of fires to be effective. This suggests that the fire planner may have difficulty when using the indexes to measure the fire occurrence potential. The indexes do associate a small percent of the days with a larger percent of the fires on the South Tongass.

[3/] See footnote 1.

Table 4.--*Fire occurrence on the Chugach, North Tongass, and South Tongass National Forests, Alaska, 1956-67; by buildup index class*

National Forest	Buildup index class									
	0-10	11-20	21-30	31-40	41-50	51-60	61-70	71-80	81-90	91-100
Chugach:										
Number of fires	14	13	17	15	15	5	4	6	1	1
Cumulative number of fires	14	27	44	59	74	79	83	89	90	91
Cumulative percent of fires	15	30	48	64	81	87	91	98	99	100
Cumulative percent of days	24	42	58	70	80	87	91	95	97	99
North Tongass:										
Number of fires	35	17	6	13	2	3	0	0	0	0
Cumulative number of fires	35	52	58	71	73	76	76	76	76	76
Cumulative percent of fires	46	68	76	93	96	100	100	100	100	100
Cumulative percent of days	50	78	89	96	98	99	100	100	100	100
South Tongass:										
Number of fires	16	15	6	6	6	2	4	6	0	0
Cumulative number of fires	16	31	37	43	49	51	55	61	61	61
Cumulative percent of fires	26	51	61	70	80	84	90	100	100	100
Cumulative percent of days	69	88	95	98	99	99	99	100	100	100

ACREAGE BURNED

A listing of fires by final size class shows 7 percent of the fires attain 10 acres and larger and just over 1 percent reach 300 acres (table 5). Compared with national statistics, this percentage of fires over 10 acres can be judged lower than normal and the percentage of 300-acre fires near normal. The three large-size-class fires burned during the first half of the study period and accounted for a large portion of the total acreage (table 6).

One fire in the black spruce cover type accounted for a majority of the acres burned (table 7). During the 12 years, 1,705 acres of commercially important Sitka spruce, western hemlock, and mixed hemlock-spruce cover types burned. Conifer slash has not been a problem, though the increased number of large logged-over areas presents a potentially hazardous fuel situation.

The relationships between spread index, buildup index, and acreage burned are summarized in tables 8 and 9. The number of fires that occurred

Table 5.--*Fire occurrence in Region 10, Alaska, 1956-67; by size class and Ranger District*

Ranger District	Size class (acres)					Total
	0-0.25	0.25-10	10.1-100	100.1-300	300+	
Anchorage	11	6	2	1	0	20
Cordova	2	0	0	0	0	2
Kenai	56	12	1	0	1	70
Chatham	29	5	3	0	0	37
Petersburg	12	3	1	0	0	16
Sitka	21	2	1	1	0	25
Wrangell	7	1	0	0	0	8
Craig	7	1	1	0	0	9
Kasaan	11	2	2	0	0	15
Ketchikan	30	8	1	0	2	41
Total	186	40	12	2	3	243

Table 6.--*Acreage burned in Region 10, Alaska, 1956-67; by Ranger District and year*

Year	Anchorage	Cordova	Kenai	Chatham	Petersburg	Sitka	Wrangell	Craig	Kasaan	Ketchikan	Region 10
1956	0	--	2	0	0	--	--	--	--	0	2
1957	180	--	32	0	0	0	--	--	0	--	212
1958	--	--	4	7	6	0	0	0	12	1,442	1,471
1959	82	--	3,278	0	--	0	--	--	0	0	3,360
1960	--	--	0	4	--	47	0	0	0	0	51
1961	5	--	1	--	--	--	0	0	--	--	6
1962	2	--	0	--	--	0	0	--	1	0	3
1963	0	0	0	66	0	1	--	--	0	0	67
1964	--	--	0	--	0	0	--	0	--	0	0
1965	--	--	0	26	0	0	0	--	0	0	26
1966	0	0	0	0	0	0	--	0	37	1	38
1967	0	--	0	3	24	136	4	--	--	0	167
Total	269	0	3,317	106	30	184	4	0	50	1,443	5,403

Table 7.--*Acreage burned in Region 10, Alaska, 1956-67; by Ranger District and cover type*

Cover type	Anchorage	Cordova	Kenai	Chatham	Petersburg	Sitka	Wrangell	Craig	Kasaan	Ketchikan	Region 10
Nonforest	--	--	5	3	1	135	0	--	12	0	156
Scrub	0	--	2	2	23	--	--	0	38	0	65
Noncommercial interior woodland	--	--	--	7	--	47	--	--	--	--	54
Western hemlock	--	--	0	0	6	0	--	--	0	0	6
Sitka spruce	180	--	0	0	0	--	0	0	--	--	180
Hemlock-spruce	43	0	0	27	0	2	4	0	0	1,443	1,519
Cedar	--	--	--	--	--	--	--	--	--	--	--
Hardwood	--	--	0	65	--	--	--	--	--	--	65
Paper birch	--	--	0	--	--	--	--	--	--	--	0
Aspen	--	--	0	--	--	--	--	--	--	--	0
White spruce-paper birch	--	--	24	--	--	--	--	--	--	--	24
Conifer slash	1	--	--	--	--	--	--	0	--	0	1
White spruce	40	--	6	--	0	0	--	--	--	--	46
Black spruce	5	--	3,278	--	--	--	--	--	--	--	3,283
Brush	--	--	2	2	--	--	--	--	--	0	4
Cover type unknown	--	--	--	--	--	0	0	--	--	--	0
Total	269	0	3,317	106	30	184	4	0	50	1,443	5,403

in each fire danger class is included so a relative acreage-per-fire value is available. The indexes successfully measure the potential for fires to spread. For example, on the Chugach Forest the 87 percent of the fires occurring when buildup index was 60 or below burned only 7 percent of the acreage. In addition, 90 percent of the fires occurring when the spread index was 40 or less burned only 2 percent of the acreage. Both indexes separate the large acreage fires into the higher fire danger classes. This general pattern holds on all forests.

DISCUSSION AND CONCLUSIONS

The fire load of the National Forests in Region 10 during the 12-year period was 20 fires and 450 acres burned per year. The greatest occurrence, 37 fires with 1,471 acres burned, was in 1958, and the greatest loss in a year was 3,360 acres in 1959. The lightest season was in 1961 when 10 fires occurred. During the 12 years, the Kenai District had the heaviest fire load in the Region with 70 fires, and Cordova the lightest with only 2.

Coastal Alaska's fire season starts with the first 10-day period in April, peaks early in July, and ends with the first 10-day period of October (table 10). Fires have spread potential from the beginning of the season through August, with the probability for reaching large size classes greatest between the middle of May and the middle of July (table 11).

Table 8.--*Acreage burned on the Chugach, North Tongass, and South Tongass National Forests, Alaska, 1956-67; by spread index class*

National Forest	Spread index class						
	0-10	11-20	21-30	31-40	41-50	51-60	61-70
Chugach:							
Number of acres	0	9	206	33	3,297	1	40
Cumulative number of acres	0	9	215	248	3,545	3,546	3,586
Cumulative percent of acres	0	0.2	6	7	99	99	100
Cumulative percent of fires	7	37	62	90	96	99	100
North Tongass:							
Number of acres	2	26	40	1	119	0	0
Cumulative number of acres	2	28	68	69	188	188	188
Cumulative percent of acres	1	15	36	37	100	100	100
Cumulative percent of fires	23	45	70	84	97	100	100
South Tongass:							
Number of acres	1	0	1	19	37	688	747
Cumulative number of acres	1	1	2	21	58	746	1,493
Cumulative percent of acres	0	0	0	1	4	50	100
Cumulative percent of fires	11	30	52	70	87	93	100

Although local permanent residents are responsible for more fires than any other class of people, the transient and sportsman segments of the population are also accountable for a large number. In a planned fire prevention program,

Class of people	Number of fires	Number of acres burned
Local permanent resident	47	51
Other	41	71
No data	40	80
Transient	39	39
Sportsman	30	687
Contractor	18	3,306
Permittee	10	789
Owner	9	245
Public employee	5	135
Seasonal	4	0

Table 9.--*Acreage burned on the Chugach, North Tongass, and South Tongass National Forests, Alaska, 1956-67; by buildup index class*

National Forest	Buildup index class								
	0-10	11-20	21-30	31-40	41-50	51-60	61-70	71-80	81-90
Chugach:									
Number of acres	6	40	0	32	183	0	3,278	42	5
Cumulative number of acres	6	46	46	78	261	261	3,539	3,581	3,586
Cumulative percent of acres	0.2	1	1	2	7	7	99	99	100
Cumulative percent of fires	15	30	48	64	81	87	91	98	100
North Tongass:									
Number of acres	7	35	31	115	0	0	0	0	0
Cumulative number of acres	7	42	73	188	188	188	188	188	188
Cumulative percent of acres	4	22	39	100	100	100	100	100	100
Cumulative percent of fires	46	69	78	100	100	100	100	100	100
South Tongass:									
Number of acres	1	0	0	714	0	19	0	759	0
Cumulative number of acres	1	1	1	715	715	734	734	1,493	1,493
Cumulative percent of acres	0	0	0	48	48	49	49	100	100
Cumulative percent of fires	27	53	66	74	83	86	91	100	100

efforts directed toward reducing the number of contractor, permittee, and sportsman fires would have the most influence in lessening burned area. People engaged in recreation, land occupancy, smoking, and land clearing activities cause the most fires. However, land clearing, forest utilization, and recreation activities are the specific causes of most of the burned acreage.

Specific cause	Number of fires	Number of acres burned
Recreation	91	301
Miscellaneous	53	206
Land occupancy	35	138
Smoking	22	40
Land clearing	16	3,932
Forest utilization	9	771
Railroad	6	10
Equipment	5	4
Lightning	4	1
Incendiary	2	0

Table 10.--*Fire occurrence in Region 10, Alaska, 1956-67; by 10-day periods*[1/] *and month*

Month	Days of month			Total
	1-10	11-20	21-30	
January	0	1	0	1
February	0	1	0	1
March	0	0	1	1
April	3	3	10	16
May	11	11	21	43
June	14	17	20	51
July	32	17	13	62
August	20	9	9	38
September	12	3	9	24
October	2	1	1	4
November	0	1	1	2
December	0	0	0	0

[1/] The length of the last period varies to include the remaining days in the month.

Table 11.--*Acreage burned in Region 10, Alaska, 1956-67; by 10-day periods*[1/] *and month*

Month	Days of month			Total
	1-10	11-20	21-30	
January	0	0	0	0
February	0	0	0	0
March	0	0	135	135
April	0	0	28	28
May	8	184	123	315
June	3,961	82	2	4,045
July	79	765	2	846
August	26	6	1	33
September	1	0	0	1
October	0	0	0	0
November	0	0	0	0
December	0	0	0	0

[1/] The length of the last period varies to include the remaining days in the month.

These summaries are descriptive of the fire problem in coastal Alaska and should be useful in development of both suppression and prevention plans. The future development of a stronger planning base will require a concerted effort at recordkeeping to develop good basic fire data.

This analysis identifies segments of the population and specific activities that reportedly start a large number of fires. The occurrence rate over time has decreased despite increased activity throughout the Region. There is a recognizable shift in occurrence among the Districts.

The relationships established between the fire danger indexes show that buildup index and spread index may be poorly related to fire occurrence. The indexes do separate the large-size-class fires into the high fire danger classes.

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